

WHAT IS CLAIMED IS:

1. A light deflector comprising an electro-optic photonic crystal in which the refraction angle of light  
5 incident from outside can be controlled by controlling an electric field applied to the electro-optic photonic crystal so as to change the refractive index of the material constituting the photonic crystal and in which the change in the refraction angle in response to the change in the unit  
10 refractive index of the material is  $10^3$  degrees or more.
2. A light deflector according to Claim 1, wherein the electro-optic photonic crystal comprises a combination of a plurality of first dielectric members and a second dielectric  
15 member or a combination of a first dielectric member and a plurality of second dielectric members, the first dielectric member comprising a material with a dielectric constant changeable by an electric field in which the dielectric constant is controlled by an electric field, the second  
20 dielectric member having a different dielectric constant from that of the first dielectric member, wherein the plurality of first dielectric members or second dielectric members are periodically arrayed separately from each other; the other dielectric member is disposed in the space of the periodic  
25 arrangement; and the first dielectric member comprises a material selected from the group consisting of  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$ ,  $\text{BaTiO}_3$ ,  $\text{GaAs}$ ,  $\text{ZnO}$ ,  $\text{NH}_4\text{H}_2\text{PO}_4$ , and  $\text{KH}_2\text{PO}_4$ .

3. A light deflector according to Claim 2, wherein a plurality of regions in which air is present as the second dielectric members are periodically arrayed separately from each other in the first dielectric member.

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4. A light deflector according to Claim 2, wherein a plurality of first dielectric members are periodically arrayed separately from each other and a region in which air is present as the second dielectric member is disposed in the  
10 space of the periodic arrangement.

5. A light deflector according to Claim 1, wherein the direction of the electric field applied to the electro-optic photonic crystal corresponds to the direction with a higher  
15 electro-optic coefficient of the electro-optic photonic crystal.

6. A light deflector according to Claim 1, wherein the direction of the light incident from outside corresponds to a  
20 direction other than the direction of the normal line of the dispersion surface of the electro-optic photonic crystal.

7. An optical switch comprising:  
a light deflector according to Claim 1; and  
25 a photonic crystal waveguide,  
wherein the photonic crystal waveguide has a photonic bandgap for light of a predetermined wavelength and also has at least one waveguide which passes the light of the

predetermined wavelength.

8. An optical device comprising:

5        a light deflector comprising a photonic crystal having a first dielectric member and configured to change the refractive angle of incident light in response to an electric field applied to the crystal, wherein the electric field changes the refractive index of the first dielectric member.

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9. The optical device as recited in claim 8 wherein the photonic crystal comprises a combination of the first dielectric member and a second dielectric member, wherein the dielectric constant of the first dielectric member is  
15 different than the dielectric constant of the second dielectric member and wherein the refractive index of the first dielectric member varies in response to the magnitude of the applied electric field.

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10. The optical device as recited in claim 9 wherein the change in the refraction angle occurs in response to the change in the unit refractive index of the material and the change is greater than or equal to about  $10^3$  degrees or more  
25 per unit change in refractive index.

11. The optical device as recited in claim 9 wherein the combination comprises a plurality of the first dielectric

members arranged in a regular periodic array in the space formed by the second dielectric member and wherein each of the plurality of first dielectric members is configured in a columnar shape.

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12. The optical device as recited in claim 9 wherein the combination comprises a plurality of second dielectric members arranged in a regular periodic array in the space formed by the first dielectric member and wherein each of the  
10 plurality of second dielectric members is configured in a columnar shape.

13. The optical device as recited in claim 8 wherein the first dielectric member comprises one of the group  
15 consisting of  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$ ,  $\text{BaTiO}_3$ ,  $\text{GaAs}$ ,  $\text{ZnO}$ ,  $\text{NH}_4\text{H}_2\text{PO}_4$ , and  $\text{KH}_2\text{PO}_4$ .

14. The optical device as recited in claim 8 further comprising a photonic crystal waveguide configured to receive  
20 light refracted by the light deflector and comprising a combination of the third dielectric member and a fourth dielectric member, wherein the dielectric constant of the third dielectric member is different than the dielectric constant of the fourth dielectric member and wherein the  
25 dielectric constant of the third dielectric member varies in response to the magnitude of the applied electric field.

15. The optical device as recited in claim 14 wherein

the photonic crystal waveguide has a photonic bandgap corresponding to light of a predetermined wavelength and at least one waveguide that passes light of the predetermined wavelength.